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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER	
UHLIR, NIKOLAS J	

ART UNIT	PAPER NUMBER
1773	4

DATE MAILED: 05/13/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/900,771	MASE ET AL.	
	Examiner	Art Unit	
	Nikolas J. Uhlir	1773	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____ .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-20* is/are rejected.

7)☒ Claim(s) *2* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 2 .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other:

DETAILED ACTION

Priority

1. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

Claim Objections

2. Claim 2 is objected to because of the following informalities: the claim recites the term "several tens microns." This is not proper English. Appropriate correction is required.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 1-20 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

5. In claim 1, the applicant claims a "composite" comprising a "base material radiating a large amount of heat at a high-temperature phase, **in combination with** a phase-change substance." The term "composite" coupled with the phrase "in combination with" indicates to the examiner that the applicant is claiming a **mixture** of a phase change substance and another "base" material. No indication of a layered structure is present in this claim. However, in the specification, the applicant's invention seems to be directed primarily towards a two-layer laminate, comprising a reflecting base layer, and a phase-change material layer deposited on the base layer. It is unclear

to the examiner from the claim language whether the applicant is claiming a composite mixture or a two-layer laminate. The same issue is also present in claim 13. Clarification is required.

6. In claims 7 and 17, the applicant requires that the base material be made of silicon**e,** alumina, or zirconia. However, on page 13 of the specification, the applicant indicates that silicon, alumina, or zirconia are suitable base materials. It is unclear to the examiner whether the applicant intended to claim "silicone" instead of silicon. However as only silicon is supported by the specification, the examiner believes the claim to silicone is in error.

7. Claims 2, 7, and 17 recite the term "**or the like**". The phrase "or the like" renders the claim(s) indefinite because the claim(s) include(s) elements not actually disclosed (those encompassed by "or the like"), thereby rendering the scope of the claim(s) unascertainable. See MPEP § 2173.05(d). Correction is required.

8. In claim 19, the applicant requires that the composite material be affixed to a surface either directly or via an intervening heat-substance. This claim is dependent on claim 13, which requires that the composite be mounted either directly or indirectly to an object. It is unclear to the examiner why claim 19 requires that the composite be mounted "either directly" to a substrate, as this limitation appears to be already present in claim 13. Clarification is required.

9. Claims 12 and 20 require that the heat controller be applied to an object, wherein the object includes an "electric or electronic circuit used in a space vehicle, including a man made satellite and a spaceship." It is unclear to the examiner exactly what "object"

the applicant is claiming. Is the applicant claiming applying the composite to a circuit, i.e a computer chip or circuit board present in a space vehicle, or simply applying this coating any portion of a satellite or spaceship? Clarification is required.

10. The terms "high-temperature" "low-temperature," "large," "small," and "high reflectivity" in claims 1 and 13, and "several" in claim 2, are relative terms which render these claims indefinite. The terms stated are not defined by the claims, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention. Correction is required.

Claim Rejections - 35 USC § 103

11. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

12. Claims 1-5, 7-9, and 12-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Okamoto et al. (US2001/0027856A1) in view of Teeg et al (US3565671).

13. For the purpose of this examination, the examiner has interpreted claim 1 as requiring a base layer of a highly reflective material and a second layer of a phase changing material on the highly reflective base material, wherein the phase changing material exhibits metallic properties at the low temperature phase, insulating properties at the high temperature phase, high heat radiation at the high temperature phase, low

heat radiation at the low temperature phase, and high reflectivity to thermal infrared radiation at the low temperature phase. Further, for the purpose of this examination, the examiner has assumed that the claim to a base material of "silicone" made in claims 7, and 17 is in error, and that the applicant intended to claim "silicon," as "silicon" is supported by the specification (page 13) and "silicone" is not.

14. The limitations "formed by either a coating method, printing method with a thick film, a depositing method or the like," in claim 2, and "laminated onto" in claims 8 and 18 are product-by-process limitations and is do not appear to be further limiting in so far as the structure of the product is concerned. "[E]ven though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process." *In re Thorpe*, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985). See MPEP § 2113.

15. Okamoto et al. teaches a heat control device suitable for use on an artificial satellite or spacecraft (page 1, section 1). This heat control device comprises a variable phase substance arranged on the heat radiation surfaces of a spacecraft. The variable-phase substance is a manganese perovskite oxide that undergoes a phase transition around room temperature. This substance has the characteristics of a metal at the low temperature phase, and the characteristics of an insulator at the high temperature phase. Further, this substance has a low heat radiation ratio at low temperature, and a

high heat radiation ratio at high temperature (page 1, section 0016). Figure 2 clearly shows that this material exhibits higher infrared reflectivity in the low temperature phase as opposed to the high temperature phase. Thus, the material regulates the amount of heat radiated from the surfaces of the spacecraft on order to control the internal temperature of the spacecraft (page 1, section 2). This phase-change material is mounted in the form of a film on the heat radiation surfaces of a spacecraft, and so is light-weight and space saving (page 1-2, section 0019). This film is typically several hundred microns thick (page 2, section 0022). The examiner takes the position that the "several hundred" micron thick film taught by Okamoto et al. meets the thickness limitation of claim 2. Claim 2 requires the phase change material to have a thickness "from one to several tens microns." A 200 micron thick film could also be reported as having a thickness of 20 "tens microns". Thus, the limitations present in claim 2 are met. Okamoto et al. further teaches that when this material is mounted on a position that receives sunlight, a silicon plate transparent to thermal infrared but opaque to sunlight may be positioned in front of the variable phase substance in order to minimize sunlight absorption (pages 1-2, section 19). This material is applied to a surface via conventional means, such as crystalline adhesion, powder coating, or other affixing means (page 2, section 24).

16. Okamoto et al. does not teach a composite material comprising a highly reflective base material that has been coated with a layer of phase-change material. Further, Okamoto et al. does not teach a heat controller that comprises a base and a phase-change coating, wherein the base is thicker then the phase change coating. In addition,

Okamoto et al. does not teach a heat controller comprising a base layer made of a material selected from the group consisting of silicon, alumina, partially stabilized zirconia, or the like, wherein the base has flexibility.

17. Teeg et al. teaches a passive thermal control system for an enclosure such as a spacecraft or an artificial satellite, which comprises a surface of a highly reflective material such as aluminum, and a coating of a phase change material such as vanadium dioxide deposited on the exterior face of the reflective surface (column 3, lines 23-31). VO_2 exhibits a thermally induced change in radiation transmissivity at a predetermined temperature (Column 1, lines 13-17) and an increase in system reflectance with increasing temperature (column 2, lines 50-55). The highly reflective metal surface can be a coating deposited on the body surface, wherein the VO_2 is then deposited on the coating, or if the body surface is manufactured out of a metal such as aluminum, the outer surface may be polished to a mirror finish, and the VO_2 coating may be disposed directly onto the polished substrate surface (column 3, lines 40-47). Although, Teeg et al. does not teach a reflective surface comprising alumina (AL_2O_3), the examiner takes the position that the limitations of claims 7 and 17 are met, as it is well known that a thin layer of aluminum oxide (Al_2O_3) forms on almost every surface of aluminum, unless special precautions are taken to prevent this oxidation. Although the phase change layer reflects some of the incident energy impinging on it while it is in the high temperature phase, much of the energy is transmitted through the material. The purpose of the highly reflective surface is to ensure that almost all of the incident radiant energy impinging on the body is radiated back into space when the body is above the

transition temperature of the phase change coating (Column 4, lines 47-55). Thus, the reflective layer enhances the ability of the system to radiate heat into space at high temperature.

18. Therefore it would have been obvious to one with ordinary skill in the art at the time the invention was made to modify the heat control device taught by Okamoto et al. by providing a reflective aluminum surface base (in the form of a coating or polished aluminum substrate) adjacent to the side of the heat control device that is mounted to the substrate.

19. One would have been motivated to make this modification due to the increase in the ability of an object such as a satellite or spacecraft to radiate heat into space at high temperature.

20. The examiner acknowledges that the Okamoto et al. perovskite MnO phase change material and the VO_2 phase change material taught by Teeg et al. possess opposite material properties. However, both patents are directed towards solving a common problem, the maintenance of the temperature of a spacecraft or satellite. The Okamoto et al. material maintains the temperature by regulating the amount of heat radiated from the surfaces of the object. At low temperature, the Okamoto et al. material is reflecting, and thus preventing energy from radiating into space. Conversely, at high temperature, the material is transmissive, thereby allowing energy to be radiated and cool the internal temperature of the object. Teeg et al. teaches that a reflective aluminum surface ensures that almost all of incident radiation is radiated back into space, thus preventing a rise in temperature due to external radiation at high

temperature. Thus, the addition of a reflective aluminum surface not only provides a suitable surface for radiating energy, but also ensures that virtually no external energy is absorbed by the surface, thereby increasing radiation efficiency. Thus, there is motivation to add a reflective aluminum surface to the heat control device taught by Okamoto et al. Further, although neither patent discloses a that the thickness of the "base" upon which the heat control device is mounted is thicker then the layer of phase change material, the examiner takes the position that this limitation is met by the combination of these two patents, particularly in the case where the heat control device is applied to a surface that is manufactured of polished aluminum. These surfaces are typically the exterior panels of satellite, which necessarily would be thicker then the "several hundred micron" coating taught by Okamoto et al. Thus, the limitations of claims 3 and 14 are met.

21. Claims 1, 6, and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Okamoto et al. as modified by Teeg et al., further in view of Hasuda et al. (US4666760).

22. Okamoto et al. as modified by Teeg et al. teaches all of the limitations of claims 1 and 6 except for those limitations stated below.

23. Okamoto et al. as modified by Teeg et al. does not teach a heat control device comprising a base layer coated with a layer of phase change material, wherein the base layer has a thickness between 10-100μm.

24. Hasuda et al. teaches a flexible optical solar reflector (OSR) for use on artificial satellites (column 1, lines 5-14). This OSR comprises a heat radiation layer made of a

poly-diphenylether, and a thin layer of a solar reflecting material such as aluminum formed on the heat radiation layer (Column 3, lines 25-60). The thickness of the heat radiation layer is 10-300 microns, and the thickness of the aluminum layer is 500-9000 angstroms. This multilayer material has excellent ultraviolet and radioactive ray resistance, low solar light absorption, and high thermal emittance. Further, this material is flexible, and can be applied over curved surfaces (column 4, lines 16-23).

25. Therefore it would have been obvious to one with ordinary skill in the art at the time the invention was made to use replace the aluminum coating taught by Okamoto et al. as modified by Teeg et al. with the flexible OSR material taught by Hasuda et al.

26. One would have been motivated to use this material due to the flexibility of the curved OSR material.

27. The examiner acknowledges that there is no teaching in Hasuda et al. to use the flexible OSR material as a base layer in a heat-regulating device. However, the reflective aluminum material taught by Okamoto et al. as modified by Teeg et al. and the flexible OSR material are providing the same function (heat radiation with low solar absorption) on the same platform (satellites). Further, both materials have an aluminum layer that provides a desired level of solar energy reflectance. The benefit of the Hasuda et al. material is that it is flexible and can be formed around curved surfaces. Thus, because both the aluminum layer taught by Okamoto et al as modified by Teeg et al. and the flexible OSR material taught by Hasuda et al. perform equivalent functions, and because the Hasuda et al. material is flexible, there is motivation to combine the references.

28. Claims 1 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Okamoto et al. as modified by Teeg et al. further in view of Bjorndahl et al. (US6005771).

29. Okamoto et al. as modified by Teeg et al. teaches all of the limitations of claims 1 and 10 as stated above, except for those limitations stated below.

30. Okamoto et al. as modified by Teeg et al. does not teach thermally connecting a heat controller to an object via an appropriate intervening adhesive.

31. Bjorndahl et al. teaches an electronics packaging structure useful for cooling spacecraft electronics equipment modules. The structure in general comprises a radiator panel, and at least one circuit chip package mounted on the radiator panel. The structure may further comprise a quantity of thermally conductive adhesive positioned between the integrated circuit chip package and the radiator panel to enhance heat conduction to the radiator panel (column 1, lines 25-42).

32. Therefore it would have been obvious to one with ordinary skill in the art at the time the invention was made to incorporate a layer of thermally conductive adhesive between the heat control device taught by Okamoto et al. as modified by Teeg et al. and the surface upon which the heat control device is mounted.

33. One would have been motivated to make this modification due to the teaching in Bjorndahl et al. that a layer of thermally conductive adhesive enhances the transfer of heat from a heated element to a radiator panel in spacecraft, and the teaching in Okamoto et al. that the heat control layer may be applied via any conventionally known affixing means.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nikolas J. Uhlir whose telephone number is 703-305-0179. The examiner can normally be reached on Mon-Fri 7:30 am - 5 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Paul Thibodeau can be reached on 703-308-2367. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9310 for regular communications and 703-872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-305-0389.

nju
May 9, 2002

Paul Thibodeau
Supervisory Patent Examiner
Technology Center 1700